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Why Use RFID to Track RTIs

Learn how to reduce costs, shrinkage and downtime

Whitepaper Part 1

Logistics without the systematic mapping of the movements of returnable transport items (RTIs) such as pallets, mesh boxes, or plastic crates leads to uncountable current inventories or lost RTIs. This results in high expenses due to the build-up of safety stocks or expensive transport. This white paper outlines the value proposition for using RFID to efficiently manage a pool of RTIs across the complete process chain of production. On the following pages, you will learn what makes a holistic tracking technology stand out and how enhanced visibility and control in load carrier management create added value in production logistics and lead to higher transparency of the entire pool and loss prevention.

In the first part, the white paper shows how enormous savings potentials can be realized by using Radio Frequency Identification (RFID) technology in the management of RTI pools. The second part of the white paper focuses at the different identification technologies that can be used to uniquely assign RTIs – and which of these are best suited for specific application scenarios.

WHY USE RFID TO TRACK RTIs

Simply put, it doesn't make economic sense to invest in reusable transport items only to treat them as disposable ones. Efficient and cost-friendly pool management makes the RTI a powerful tool in building sustainable supply chains. However, shrinkage, damage or simply inefficient management lead to additional RTI procurement in order to avoid short-term shortages and thus downtime, so that the actual total inventory exceeds the optimal quantity. Often, no one even knows exactly how many reusable containers are in use throughout the entire process chain – and that's the problem. Optimizing the time and cost of transporting goods helps companies free up valuable capital and other resources.

From a business perspective, it is of great importance that the number of RTIs in the loop is kept as low as possible in order to tie up little capital. At the same time, however, containers must be available in sufficient numbers to prevent disruptions in the supply chain or loss of sales. In the worst case, which is not uncommon, there is a risk of standstill on the just-in-sequence or just-in-time line because the RTIs are not available or not available in sufficient quantities where they are needed at the moment. In this case, containers must be made available at short notice, no matter what it costs: couriers are hired to pick up empty RTIs or replacement containers are procured. The pool owner then invoices the customer for these or is left to bear the costs himself.

RFID-based load carrier management allows these requirements to be implemented with a low level of administrative activities. It speeds up the process and also prevents possible manual errors.

Understanding the Business Case in Tagging RTIs

A pool of RTIs is usually shared by multiple partners within the loop. However, RTI pools can be quite ineffective if the pool owner does not keep track of the whereabouts of the RTIs. High capital costs are typical for shared pools as RTIs are not returned or are lost or broken. The pool operator owns the RTIs that circulate between a number of partners. He matches the RTI quality to the requirements of the supply chain partners and the quantity to their needs. However, he cannot know the status or availability of the RTIs until he receives and verifies them.

Managing the RTI pool

Getting back RTIs from partners – The pool owner needs to have his containers back as soon as possible after use. Therefore, he wants to ensure reliable tracking of empty RTIs because many partners tend to simply keep them longer than they need them. The reason for this is that RTIs are usually seen by partners as incidental and not worth bothering about their whereabouts. Tracking and the RTIs themselves are often a low priority because the goods they carry are more important to them first. In addition, they often do not consider the value of the RTIs or the cost to the owner. This ultimately results in longer cycle times and unnecessarily high inventories on their own end.

Having enough RTIs in each process step – RTIs are a critical factor in ensuring the quality of production operations. In particular, it must be ensured that they are always in the right place at the right time in the right quantity and quality. To prepare filled RTIs, the delivery sites must have enough empty RTIs in stock. Therefore, the receiving sites' inventories must also be managed. So empty RTIs have to be delivered to the supplying sites in time and picked at the receiving sites.



Many partners tend to keep empty RTIs longer than they need them. This takes the containers out of the loop, resulting in unnecessarily high inventory levels on their side and costly inventory restocking on the pool owner's side.

Control quality of RTIs in the pool – Containers equipped with RFID tags allow full bulk detection, guarantee complete batch tracking at container level and enable the pool owner to optimize empties management through real-time inventory information. This prevents vacancies at his sites and allows staff to work more efficiently without time-consuming searches, because they can check the location of each RTI at any time.

Counting usage time of different stakeholders – The pool owner rents his RTIs to the partners and gets paid per loop. Billing becomes an easy task when he knows how many containers have been sent to a partner, when and how many had been returned. RFID tags on each RTI allow their movement to be accurately tracked using fixed readers at strategic entry and exit portals or handheld readers for mobile reading points at remote locations. In this way, the pool owner can accurately account for each rented container. It also allows all partners to be held accountable for the RTIs that pass through their facilities. Partners can be held liable for lost and damaged RTIs because there is a clear container history through the recorded transfer points and times.

Tracking the item on top of the RTI

It is of high economic importance to control an investment as large and constantly moving as RTIs to match supply and demand. Seamless tracking requires unique identification of containers and real-time communication with all players within the loop.

Multi Tag reading for shipment verification – It is crucial that shipping and loading of shipments occur quickly, especially during peak periods. High-frequency (HF) and especially ultrahigh-frequency (UHF) readers are designed to read multiple RFID tags simultaneously, such as a pallet of RTIs moving through a reading gate. This means that multiple RFID tags can be read quickly and simultaneously without the need for direct visual contact.

Marriage of RTI and content – For RTI tracking, all containers are tagged with RFID tags. RTIs and the associated goods are then assigned to each other in the ERP system. This is also referred to as marrying the RTI and the goods. This means that both objects can be identified quickly and reliably at any time. In this way, for example, large quantities of small load carriers on a pallet can be loaded into a truck, which for speed reasons cannot be read simultaneously by the reader. Instead, an RFID tag is attached to the pallet, which stores load-related characteristics such as article numbers and quantity of the load carriers.

The types of RTI you may wish to RFID tag

Selecting the right container type is an essential task for logistics managers. Containers range in size from not much bigger than a shoebox to pallet-sized for larger items. They should be reliable, sustainable and durable, save material and minimize costs. However, each industry also has individual requirements for its RTIs. Accordingly, the variability in RTIs is very large. In order to ensure seamless RTI tracking, all container types must be detectable by means of RFID. Therefore it is important that the RFID tags used are consistently and reliably readable on all substrates – i.e. when applied to plastic, metal and ESD materials and even when the container is folded.

Plastic RTIs with RFID labels – Plastic crates are the most wide-spread option for a large number of applications and industries, to transport, handle and store many kinds of product. UHF RFID labels are perfect for plastic crates. They are highly resistant to external influences and harsh environmental conditions. As the optimal solution for tracking returnable plastic crates and pallets, these special RFID tags are designed to withstand multiple washings while providing companies with a cost-effective solution that increases efficiency, reduces inventory shrinkage, promotes sustainability and streamlines their delivery processes.



Standardized plastic RTIs enable integration into automated processes, e.g. at the conveyor belt.

ESD plastic RTIs with ESD RFID tags – Containers made of ESD materials are a particular challenge for RFID applications because the dissipative material structure interferes with the tag's feedback to the reader. For these ESD containers, there are tags that have been specially developed for anti static processes and ensure consistent performance with maximum results.

Steel pallets and boxes with on metal tags – Steel pallets and boxes offer high load capacity, are available in galvanized or painted steel, with steel or wooden bottoms, are highly impact resistant and have a long service life when well maintained. The use of RFID tags on steel pallets and boxes is fraught with difficulties: Metal surfaces reflect the energy emitted by RFID readers, interfering with RFID tag antennas and thus with information transmission. For use cases under such conditions, there are particularly resistant RFID data carriers, so-called on metal tags, which are suitable for mounting directly on metal. Insulating materials inside the tag prevent a short-circuit of the ends of the antenna.

Choosing the Right RFID Tag Type for Different RTIs

RFID solution architecture always starts by choosing the correct RFID tag to the items, which in turn depends on the application in each case. If the chosen tags are not suitable for the application, if they are not sufficiently durable to withstand the process or if they do not deliver the necessary performance (in terms of reading range), the reading rate of the RFID system will be too low or the entire system may fail. It is therefore necessary to understand the technical demands and physical conditions of the relevant process in as much detail as possible.

One-off or recyclable

The answer to the question is clear: Reusable assets need reusable tags – otherwise tracking empty RTIs is not possible. One-off tags are only of interest for logistic processes, for which RTIs are used by open pools and by other owners. For metal pallets magnetic hard tags can be an option.

Considerations related to RTI material

Wooden pallets are a very complicated item in RFID-based RTI management, as nails added during future repairs are an unknown factor. Plastic crates are easy to clean, are very manageable due to their light weight, last a very long time with respect to the material, do not absorb moisture, save space and have a much longer life than wooden pallets. Steel pallets are extremely resistant to impact, offer a high loading capacity and also have a long life.

Considerations related to environment in which RTI is used

There are hardly any limitations in the use of RFID-based systems, as there are RFID tags suitable for almost all cases and environmental conditions. The only blind spot is applications at temperatures above 230 degrees.

How to Track the RTIs with RFID Tags on them

Typically a state-of-the-art RFID turnkey solution consists of

- RFID tags, which can be attached to or embedded in the RTI to be identified
- RFID read points and their antennas, which interact with the tag without requiring a line of sight
- RFID server applications (cloud or local) for data mining and system health and maintenance including an integration layer with support to most common business systems such as ERP and WMS
- Integration to the customer's backend system
- An implementation plan

System management

The RFID server is at the heart of the RFID system and it has two main functions: RFID data management and system health and maintenance. The primary functions of the RFID data management application include data consolidation from data collection applications, integrations to business systems and reporting. Different RFID use cases are served by different RFID read points such as printers, gates, forklifts, conveyor belts and handhelds. The data collected from individual RFID read is centered in the RFID data management application, which in turn mines these data to generate reports and data for the business systems.

The data management application features

- Data and reports on material, product and asset location
- Data and reports on materials, products and assets
- Map view to report current material, product and asset location and distribution

The system health and maintenance application acts as a device manager and controls the complete RFID system. It serves both a system health and system maintenance functions. The RFID devices serving different RFID touch points are all connected to it. Each customer location and each individual device on that location can be monitored and accessed remotely from the device manager. This means that printers, gates, forklifts, conveyor belts or handhelds can be seen and their software updated when necessary.

The system health and maintenance application features

- Data and reports on RFID devices in the network
- System health alerts
- Remote access to RFID devices

RFID read points

RFID is all about collecting data from different points in the production and warehouse. The question is how to best collect the data. Choosing correct read points is related to processes and environment. Experience shows that most read points in such a system are stationary, gates or forklifts – or a mix.

The good thing is that the RFID solution looks architecture wise the same whether forklifts or gates are used. It always starts with selecting the suitable RFID tag for the RTIs. The tags are read by RFID readers that send the data to the RFID Server applications. The RFID Data Management application can link the read events to other data and then forward that data to the customer's back-end systems.

It should not matter whether the customer has forklifts, gates, stationary read points or a mixture. However, very few RFID solution provider can mix different read points concepts – like named above – reliably in their solutions.

Integration to other systems

RFID Integration means receiving information from a RFID read point, based on customer data need. To integrate with customer business applications such as ERP or WMS it should be known, what information format and type the gate can provide and what enriched data is needed in the customer's system. Oftentimes the customer system has no place for RFID data, thus only part of the data collected by RFID is forwarded. The analysis may be done in the RFID system.

Interim Summary

Decision-makers are often unaware of the digitization potential of container management. Yet containers are expensive capital goods. The absence of a suitable system for tracking leads to actually unnecessary and thus uneconomical new acquisitions. Often, paper and Excel-driven processes are still the order of the day, and networking is a long way off. RFID-based load carrier management allows availability in sufficient numbers to prevent disruptions in the supply chain or loss of sales by providing:

- Map view to report current asset location and distribution
- Data and reports on asset location
- Data and reports on assets
- Data and reports on RFID devices in the network
- System health alerts
- Remote access to RFID devices

This gives pool owners an up-to-date overview at all times of how many containers are available in warehouses and how many containers are currently on their way and where.

Turck – TVS design services for RFID system

Often the customer starting point is such, that very rough benefits of RFID technology have been identified, but not pinpointed. A detail concept about which processes have an ROI, which are feasibly implementable, and in general the dissection of the big picture and a feasible proceedings plan is needed. Or the task might be support in making the best possible choices around the RFID technology itself, for example technical specifications for highly specific applications. For this stage Turck Vilant offers process consulting by its most senior RFID experts. The TVS services for planning and implementing an RFID turnkey project are summarized in five phases:

The first phase is about developing understanding of customer needs and introducing customers to RFID. The starting point for customer engagement is the site survey to get an expert analysis of the customer's plan and process. The Turck expert visits the customer and reviews the current processes, bottlenecks and problem areas. He is introduced to business applications as well as their data needs. The target is to gain an understanding of issues that cost time and extra work or cause waste that can potentially be remedied



Turck Vilant Systems offers process consulting by its most senior RFID experts to support in making the best possible choices around the RFID technology itself, for example technical specifications for highly specific applications.

through the use of RFID technology and get a first view on feasibility by looking at the process on site, in order to elaborate useful next steps. Based on the site survey, the expert builds a report suggesting how to use RFID technology and where the ROI may be found. In this phase, the customer has the opportunity to have his employees trained in RFID workshops. Furthermore, Turck Vilant Systems offers insights to how others in the industry have solved similar issues. These services are free of charge for the customer.

In the second phase, RFID feasibility studies are conducted. For customers without experience with RFID, a proof of concept is carried out. This means testing on customer premises with real life RFID equipment to ensure the tags, readers or applications will work for the customer. By the way: Very few RFID solutions providers can mix read points in their RFID solutions – Turck Vilant Systems can.

The goal at this point is to determine the optimal configuration. Based on proof of concept or workshop, Turck Vilant Systems will prepare a requirement scope document, which the customer can use to get offers for the needed solution. After the customer accepts the Turck Vilant Systems offer, a project plan is created.

In the third phase, everything is prepared for the rollout in a pilot project. For this purpose, the RFID system is put into operation and tested on just one production line or one production estate to learn before rolling out everywhere. Real equipment, e.g. an RFID reader, is installed in the production line to check whether everything runs as planned in real operation. In this way, many things that were not considered before become visible when using the system. Accordingly, this process is accompanied by a lot of customer communication and documentation. The central question here is: Which data should be forwarded to the customer system? All functions and requirements must be clarified in detail. Standard software must also be configured and tested to ensure that everything works in the installation environment. This ensures that the customer will be able to use the RFID system smoothly later on.

Rollout and commissioning are implemented in the fourth phase. The customer installs the RFID readers, with an engineer on site to set up the software and make sure everything is working. All processes are tested live and the customer's employees are trained. The training is done in English, French, German, Swedish or Finnish. This way, the customer then has internal trainers (key users) who know how the system works and are the first contact for their colleagues when they have questions - in their native language.

Once the system is up and running, the fifth phase begins: support. Continuous system operation must be ensured, 24 hours a day – even on holidays. Turck Vilant Systems meets this customer expectation and offers global service & support 24/7. Over 90% of the issues can be solved remotely and the rest by the Turck Vilant Systems specialist on site.

Over time, new insights and requirements emerge. The planning and development of new features is carried out by Turck Vilant Systems again in phase two, RFID feasibility studies.

Summary and Conclusion

RTIs are a critical factor in ensuring the quality of production operations. RFID-based container management ensures that they are always in the right place at the right time in the right quantity and quality. This way, the cost of an RFID-based system is quickly recouped by the huge savings achieved through efficient container management, as there is no need any more to hire couriers or buy replacement containers to procure missing RTIs at short notice.


RFID offers decisive advantages over comparative technologies in the identification of RTIs, including barcodes in particular. For example, there are hardly any limitations in the use of RFID-based systems, as there are RFID tags suitable for almost all cases and environmental conditions. Furthermore, in an RFID-based system, high-volume reading can be easily automated without slow and error-prone manual steps.

To ensure a smooth RFID RTI loop, special management tools offer the possibility to display all RTI information on one platform. Thus, the RFID system closes the gap between the physical production world and IT-based MES and ERP systems. By linking objects with data from IT systems, RFID systems generate the transparency needed for lean processes and digitized supply chains. This information enables both, systems and decision-makers, to draw more informed conclusions, which leads to increased efficiency in RTI management and high resilience to seemingly unpredictable events in the loop.

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